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(54) METHOD AND DEVICE FOR PRINTING DIGITAL IMAGE INFORMATION

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a photo having no edge margin with good color reproducibility without wasting a printing ink and an image carrier material in printing digital image information.
SOLUTION: This device comprises a reflection type sensor which is so constituted that a density and a color can be measured and has a high positional resolution. Firstly, an edge of the image carrier is detected and the printing of a pixel of the digital image positioned outside the edge is prohibited. The sensor is used for photoelectrically scanning or measuring print head test patterns printed at the same time. The obtained measured data is analyzed by using an adequate algorithm and then it is possible to initiate the corresponding operation by judging the functional condition of the print head. The sensor is used again for measuring the color test patterns printed at the same time. By the measuring technology wherein the obtained measured data is analyzed and the data is compared with a reference value, it is possible to recognize and correct the change in the color reproducibility.

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CLAIMS

[Claim(s)]
[Claim 1] In the approach which prints 1 pixel of digital image information at a time on plane image support, in order to arrange 1 pixel of one or more color compounds on [each] said image support The step which carries out alignment of said image support into the airline printer relatively equipped with the one or more movable print heads to said image support, The approach characterized by including the step which forbids printing of the pixel of the step which detects the location of two edges where said image support counters by the sensor, and said image information located in the outside of said detected edge.
[Claim 2] The approach according to claim 1 which said image support is a sheet material and is characterized by catching all marginal 4 locations of said image support.
[Claim 3] The approach according to claim 1 which said image support is a band-like ingredient, and is characterized by catching only the location of the edge of said image support longitudinal direction.
[Claim 4] The approach according to claim 1 characterized by performing the step which detects the location of the edge of said image support before printing of said image information.
[Claim 5] The approach according to claim 1 characterized by performing said step which detects the location of the edge of said image support in the midst of printing of said image information.
[Claim 6] The step which prints a print head test pattern, and the step which measures said test pattern by the sensor and obtains measurement data, The step in comparison with the setups which judged the functional condition of the one or more print heads from said measurement data, and set up said functional condition beforehand, The approach according to claim 1 characterized by including the step which starts amendment processing automatically, the step which creates a status report, and the step chosen one or more from the steps which stop printing processing when the gap from said setups is in said functional condition.
[Claim 7] The approach according to claim 6 characterized by including the automatic washing process of said print head in the step by which said amendment processing is started.
[Claim 8] The approach according to claim 6 characterized by including further the step at which the activity assigned separately is transmitted to the functional device on which others function, and perfect image information is printed by these functioning functional devices when each functional device of said print head breaks down.
[Claim 9] The step which prints one or more color test patterns, and the step which measures said test pattern by the sensor and obtains color measurement data, The step in comparison with the reference value which set up said color measurement data beforehand, When the gap from said reference value of said color measurement data exceeds the preselected threshold The approach according to claim 1 characterized by including the step which starts amendment processing automatically, the step which creates a status report, and the step chosen one or more from the steps which stop printing processing.
[Claim 10] The approach according to claim 9 characterized by said amendment processing being the step which adjusts the magnitude of the drop of said color compound.
[Claim 11] The approach according to claim 9 characterized by said amendment processing being

the step which adjusts the profile of an airline printer.
[Claim 12] The approach according to claim 1 characterized by being the reflective mold photoelectrical sensor by which said sensor used is equipped with the multicolor light source for making said image support expose a measuring beam, the prehension lens for said measuring beam reflected from said image support, and the optical/electrical converter of the gestalt of linearity or a two-dimensional photoelectron sensing element.
[Claim 13] The positioning means for being equipment which prints 1 pixel of digital image information at a time, and positioning said image support on plane image support, It relates to said image support for arranging 1 pixel of one or more color compounds on [each] said image support. The one or more movable print heads, The control section to a positioning means and at least one print head, Equipment with which it has the sensor which collaborates with a control section and detects the location of at least two edges of said image support which counter, and said control section is characterized by being constituted so that printing of the pixel of said image information located in the outside of said detected edge may be forbidden.
[Claim 14] Equipment according to claim 13 characterized by being constituted so that said control section may detect the location of said edge of said image support before printing of said image information.
[Claim 15] Equipment according to claim 13 characterized by being constituted so that said control section may detect the location of said edge of said image support in the midst of printing of said image information.
[Claim 16] In order that said control section may sometimes print a print head test pattern at least In order to compare with the setups which measured said test pattern by the sensor, acquired measurement data, judged the functional condition of said at least one print head from said measurement data, and set up said functional condition beforehand, And the step which starts amendment processing automatically in case the gap from said setups is in said functional condition, Equipment according to claim 13 characterized by being constituted in order to carry out one or more steps chosen from the step which creates a status report, and the step which stops printing processing.
[Claim 17] Equipment according to claim 16 characterized by being constituted so that it has two or more print heads, and it has further an adjustment device for collaborating with said control section and adjusting a relative location arrangement of said print head, and said control section may collaborate with said adjustment device and may adjust said relative location arrangement of said print head as said amendment processing.
[Claim 18] Equipment according to claim 16 or 17 characterized by having further a means for cooperating with said control section and washing said print head automatically.
[Claim 19] Equipment according to claim 16 or 17 characterized by being constituted so that the activity assigned separately may be transmitted to the functional device on which others function and perfect image information may be printed by these functioning functional devices, when the functional device of each [control section / said] of said print head breaks down.
[Claim 20] Equipment according to claim 16 or 17 characterized by being constituted so that the magnitude of a picture element and a gap of a location may be amended, when said control section controls an adjoining picture element.
[Claim 21] In order to compare with the reference value with which at least one color test pattern was printed, and said control section measured said test pattern by the sensor, obtained color measurement data, and set up said color measurement data beforehand, When the gap from said reference value of said color measurement data exceeds the preselected threshold Equipment according to claim 13 characterized by being constituted in order to carry out one or more actuation chosen from the actuation which starts amendment processing automatically, the actuation which creates a status report, and the actuation which stops printing processing.
[Claim 22] Equipment according to claim 21 characterized by said control section adjusting magnitude of a color compound drop as amendment processing.
[Claim 23] Equipment according to claim 21 characterized by said control section adjusting the profile of said airline printer as amendment processing.
[Claim 24] Equipment according to claim 13 characterized by being the reflective mold

photoelectrical sensor by which said sensor was equipped with the multicolor light source for making said image support expose by the measuring beam, the prehension lens for said measuring beam reflected by said image support, and the optical/electrical converter of the gestalt of linearity or a two-dimensional photoelectron sensing element.
[Claim 25] Equipment according to claim 24 characterized by constituting said multicolor light source by the light emitting diode which emits the complementary color of said color compound used.
[Claim 26] In the equipment for printing 1 pixel of digital image information at a time on plane image support In order to arrange the positioning means for positioning said image support, and 1 pixel of one or more color compounds on [each] said image support As opposed to said image support relatively The one or more movable print heads, It collaborates with the control section for said positioning means and said print head, and said control section. Equipment characterized by having a photoelectrical sensor corresponding to the color constituted in order to perform detection of the location of at least two edges of said image support which counter, and measurement of a print head test pattern and a color test pattern.
[Claim 27] Equipment according to claim 26 characterized by being the reflective mold photoelectrical sensor by which said sensor was equipped with the multicolor light source for making said image support expose by the measuring beam, the prehension lens for said measuring beam reflected by said image support, and the optical/electrical converter of the gestalt of linearity or a two-dimensional photoelectron sensing element.
[Claim 28] Equipment according to claim 26 or 27 characterized by having further the driving means to which said sensor is relatively moved to said image support.
[Claim 29] Equipment according to claim 26 or 27 which said sensor is mechanically connected with the one or more print heads, and is characterized by being movable with said print head.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the approach and equipment for printing 1 pixel of digital image information at a time on the flat-surface image support in an airline printer using the movable print head.
[0002]
[Description of the Prior Art] Although production of the physical printed matter of a digital manuscript is increasingly performed by printing processing, an ink jet printer is usually used for printing. The high performance ink jet printer generally because of such a purpose used is known.

[0003]
[Problem(s) to be Solved by the Invention] In the photograph industry, a frameless photograph is searched for in many cases. However, the problem which does not still have sufficient solution follows on use of an ink jet printer. In the approach often used for production of a frameless photograph, since a small image format is chosen from the format of image support, the photograph which has the edge which is not printed is produced and this edge that is not printed is cut off. This approach will need comparatively large sum decision actuation, and will take out the waste of still more unnecessary image support.
[0004] By another general approach, a larger thing than the format of image support is chosen as the image format printed. However, the costs concerning removal of the printing ink which there is fear of dirt by the printing ink which consumes printing ink vainly by this approach, and is applied to the outside of image support, and was applied to the outside of image support are comparatively high.
[0005] Furthermore by the ink jet printer, there is a possibility of getting each nozzle of the print head blocked. Although a printing nozzle can be kept beautiful and a function can also be maintained by performing rinsing and other washing frequently, considerable printing ink will be consumed in this case. Furthermore, wear of the print head must be rash with frequent washing, and printing processing must be interrupted comparatively frequently.
[0006] What can be judged is known [which printing nozzle has stopped whether the printing nozzle is functioning in a visual target or a photoelectrical scan, and the analysis of a scan signal, and the nozzle functioning if needed, and] by printing a special test pattern occasionally.
[0007] Since there is a possibility of taking out a lot of waste, to a high performance printer, a visual inspection is not suitable. The known automatic system using a photoelectrical scan does not fit the high performance printer a comparatively large printing dot (ink droplet) and latest which it is comparatively suitable only to a small number of ink jet printer, are very high resolution, and have many very fine ink nozzles in its suitability.
[0008] A high performance ink jet printer has two or more print heads, and since the turbulence which is a foregone conclusion will arise in a printing image if adjusted to incorrectness, the print head needs to be correctly arranged mutually by expensive technique. Furthermore, if arrangement of the printing dot by each printing nozzle is inaccurate or the magnitude of the printing dot by each printing nozzle differs, the turbulence which is a foregone conclusion will

arise further. Although a certain extent can be equalized according to two or more printing paths about the latter (amendment), a print speed will fall remarkably.
[0009] The further trouble of an ink jet printer is amending the color reproduction nature which is easy to change by change of environmental conditions, such as an image support ingredient, printing ink, a print head property and temperature, and humidity. Although a color is correctly reproducible limiting the number of the image support ingredients (print media, printing substrate) to be used, and by creating a profile carefully about a printing method and each combination of an image support ingredient, the fault that an usable image support ingredient and printing ink will be restricted follows on this. In adding a new image support ingredient, a new profile must be created first and excessive costs and the skilled talented people are needed.
[0010] Therefore, this invention aims at solving the problem at the time of producing a frameless photograph by the easy and economical approach. Thereby, especially the futility of an image support ingredient and printing ink is avoided. Moreover, this invention sets it as other purposes to combine with offer of the indispensable condition for controlling other above-mentioned problems accompanying an ink jet and the same printer for the solution of the problem about production of a frameless photograph.
[0011]
[Means for Solving the Problem] This invention is attained for the above-mentioned purpose by the printing approach by this invention. In this approach, the edge of image support is preferably detected by the photoelectrical sensor, and does not print about the pixel of the digital image on the outside of the edge of image support. If an edge is detected in sufficient precision, frameless printing will be attained without doing in this way and making printing ink useless. that is, the formats of the image to print are only fewer than the format of image support -- ** -- it is chosen greatly.
[0012] If the photoelectrical sensor is constituted appropriately, it can also use for the photoelectrical scan or measurement of a print head test pattern printed by other side faces of this invention at coincidence. Corresponding treatment can be begun after judging the functional condition of the print head of an airline printer by analyzing the measurement data generated from the sensor using the suitable algorithm. Thus, generation of waste can be prevented certainly.
[0013] When a photoelectrical sensor suits density measurement or a color measurement activity, it can also use for measurement of the color test pattern printed by the side face of others of this invention at coincidence. Thus, change of color reproduction nature can be recognized on time with a measurement technique, and a suitable means can amend.
[0014] The most fundamental and overall concept of this invention is to use the single multifunctional sensor constituted specially because of two or more of a series of mutually very different photoelectric photometry activities. All the problems above-mentioned [accompanying an ink jet printer and the same printer] can respond by the easy approach which used this special multifunctional sensor (and the control section or the analysis section for the measurement data generated from the sensor corresponding to this).
[0015]
[Embodiment of the Invention] This invention is explained referring to a drawing below. The airline printer with which the whole is referred to as P at drawing 1 is equipped with the ink jet printing unit HU which usually changes from two or more ink jet print head H to the interior of a case or a frame (not shown). Ink is supplied to ink jet print head H from two or more tanks which are not shown in drawing and by which the printing ink of a mutually different color entered. Furthermore, the positioning means 1 for the image support M of the shape of the sheet printed or a web of only being symbolically shown by the both-directions arrow head (paper of usually suitable quality) is formed in the interior of a case.
[0016] A positioning means carries out the variation rate of the image support M passing through the inside of an airline printer P in the format of the convention which met displacement path 1a in relation to a printing unit HU or print head H, and controls this migration by the approach that a control section C is well-known. Furthermore, the advance means 2 controlled by the control section C of only being symbolically shown by the both-directions arrow head also here is

established in the airline printer P. It can adjust along with displacement path 2a which the print head unit HU or print head H essentially crosses displacement path 1a of image support with the advance means 2, and is extended.
[0017] The image support M and print head H are movable to the 2-way which intersects perpendicularly mutually so that it may be well-known, and each print head H can be positioned by control of a control section C in the location of the arbitration of the image support M. Print head H of the print head unit HU is controlled by the control section C, and prints the digital image information I sent to the control section C by the external computer etc. on the image support M. 1 pixel of image information I is printed at a time on the image support M with the gestalt of a detailed ink droplet by the well-known approach.
[0018] In the gestalt of practical operation, an airline printer can also be constituted as a drum recorder as indicated by the European Patent A1009158 at the detail. Such a drum recorder is usually equipped with the printing unit which is in the condition of quiescence to rotation of the rotating-clamp drum for a record medium (image support), and a clamp drum.
[0019] A printing unit consists of a shaft of a clamp drum, and the one or more print heads which can be displaced to parallel. On the other hand, the whole front face of the image support held at clamp drum lifting is transported with the variation rate of the print head which was parallel to the shaft of a tension drum on the other hand with rotation of a clamp drum again. The hand of cut or circumferencial direction of a tension drum corresponds to displacement path 1a of drawing 1 , and clamp drum shaft orientation corresponds to displacement path 2a of drawing 1 .
[0020] Since the airline printer by this invention is equivalent to the perfect and conventional ink jet airline printer on the whole so far, to this contractor, the explanation beyond this is unnecessary.
[0021] the driving means 3 which is too controlled by the control section C by the airline printer according to the most desirable side face of this invention -- full [of the image support M] -- crossing -- print head H -- receiving -- parallel -- a round trip -- it has the movable multifunctional mold photoelectrical sensor S. The multifunctional mold photoelectrical sensor S is symbolically shown by the both-directions arrow head.
[0022] Instead, Sensor S can be made to be able to connect with the print head unit HU mechanically, and it can also arrange so that it may move together with the print head unit HU. The image support M arranged caudad is scanned in photoelectricity, the scan signal generated by Sensor S is processed by the control section C with the below-mentioned format, and Sensor S is analyzed for the approach by this invention.
[0023] The main configurations of the photoelectrical sensor S are shown in drawing 2 . The photoelectrical sensor S is constituted as a reflective mold sensor corresponding to the color which has high location resolution, it has substantially the light source of the gestalt of two or more light emitting diodes 11, the prehension lens 12, and an optical/electrical converter 13, and an optical/electrical converter consists of linearity or a two-dimensional optoelectric transducer. The light source or light emitting diode 11 essentially irradiates a measuring beam to the image support M at the include angle of 45 degrees by control of Sensor S.
[0024] With the prehension lens 12, the measuring beam reflected from the front face of the image support M is caught at 90 degrees, and is oriented with an optical/electrical converter 13. An optical/electrical converter 13 changes this light into a corresponding electrical signal.
[0025] In order to raise contrast, the complementary color of the printing ink for which light emitting diode 11 is used preferably, i.e., usual, emits light in red, blue, or green. Instead of the light emitting diode of a color, the source of the white light can also be used combining a suitable color filter.
[0026] Although the prehension lens 12 is preferably formed with a refractive-index distribution pattern glass fiber, the conventional objective lens can also be used for it.
[0027] An optical/electrical converter 13 is preferably obtained by CCD or the CMOS technology, for example, has the comparatively high line resolution of 10micro. The die length of a converter may be 20-30mm. This is equivalent to the sensing element (pixel) of the number per [2000-3000] train. A converter 13 is equipped with the sensing element of one or more trains, and is connected with a control section C by drive electronic instrument 13a. The

electrical signal corresponding to the irradiated measuring beam which each sensing element generates is transmitted to a control section C by drive electronic instrument 13a by the known approach.
[0028] In the color measurement technique in a digital camera, since the photoelectric scanner (sensor) corresponding to the color which operates 1 pixel at a time with the optoelectric-transducer fields (CCD array etc.), a drive electronic instrument required for this, and a signal processor are known, this contractor is received and the above explanation is unnecessary.
[0029] The prehension lens 12 and a converter 13 are good also as the analog equipped with the drive for an optoelectric transducer, and signal-processing electronic instrument 13a, or a digital camera.
[0030] Although Sensor S scans 1 pixel of image support at a time in high location resolution in the inspection zone of a long and slender rectangle, if the measuring beam of a color is used, the color measurement by the concentration meter is also possible. Such an inspection zone is shown by the reference number 15 in drawing 3 . The die length of a typical inspection zone is about 20-30mm, and width of face is about 10micro - several mm. The linearity location resolution of a lengthwise direction is usually about 10micro. Of course, within limits which do not deviate from the framework of this invention, the dimension of an inspection zone may be chosen so that it may differ from the above.
[0031] In the usual case, orientation of the sensor S is carried out so that the lengthwise direction of an inspection zone 15 may become print head H or the displacement path of Sensor S, and parallel. Moreover, it can also arrange so that the long side of an inspection zone 15 may rotate Sensor S the include angle of 45 degrees preferably to the direction of the displacement path of print head H.
[0032] By the special configuration by this invention, Sensor S can be used for all necessary measurement, in order to solve the above-mentioned problem in printing using an ink jet printer.
[0033] According to the 1st side face of this invention, a sensor is used in order to catch the progression of the location where the edge of the image support M is exact. The information acquired about the marginal location is used in order to distinguish the image element (pixel) located in a marginal outside among the digital image information I printed so that the image element on a marginal outside may not be printed.
[0034] Although this is explained further below, it carries out by assuming that the image support M is the configuration of the web material of arbitration to what is necessary being to detect only two edges where the longitudinal direction on image support usually counters for simplification. Below, the case where the edge which crosses the migration direction of sheet-like image support or the image support M is caught is explained further.
[0035] As exaggeratingly shown in drawing 4 , the location of the edges R1 and R2 of the longitudinal direction of the image support M is changed by within the limits in relation to the fixed system of coordinates in an airline printer. This reaches in the inaccuracy of the positioning means 1 with it difficult [to prevent as a matter of fact], and, probably originates in fluctuation of the width of face of ****** support etc. Since migration of the print head and the location of the image therefore printed also relate to these fixed system of coordinates, the boundary region where the image information or the image I which should be printed recognized with two or more rectangles is larger will be located in the outside of the image support M.
[0036] The image field located in the outside of the edge of the image support M is shown as Ie in drawing 4 . In order to enable exclusion of the pixel which constitutes these image field Ie or these according to this invention (i.e., in order to enable deletion of these image elements), each point in the location of two edges R1 and R2 of the longitudinal direction of the image support in alignment with the length side of image support needs to be known.
[0037] Drawing 5 shows roughly how prehension of the location of the edge of the longitudinal direction of the image support M is theoretically performed using Sensor S. The level or signal strength of an electrical signal corresponding to the reinforcement of the measuring beam which while is prolonged in parallel [with migration direction 2a of a sensor] among the fixed system of coordinates mentioned above, and x, a call, and Shaft a generate an axis of coordinates from each sensing element of Sensor S, and is irradiated is specified. Two axes of coordinates p

specify the relative position (pixel coordinate) of each sensing element of a sensor.
[0038] a sensor -- a control section -- C -- an image -- support -- M -- width of face -- crossing -- as -- a position coordinate -- x -- ' -- and -- x -- " -- having -- drawing 5 -- S -- ' -- and -- S -- " -- being shown -- having -- two -- a ** -- a location -- width -- moving -- having . In these locations, the inspection zone caught by the sensor or the sensor is arranged above the edges R1 and R2 of the image support M. Moreover, in these locations, although the sensing element equivalent to which the measuring beam out of the field inside the edge of the image support M is transmits the signal of a high level, since a measuring beam is not equivalent to other sensing elements, it generates the signal of a low.
[0039] The sensing element in within the limits which is change of this signal level is determined by the control section C in the suitable analysis of a measurement signal, and those relative-positions p' and p" (pixel coordinate) on a sensor are determined. Pixel coordinate p' and p" specify the exact location of two edges R1 and R2 of the image support M with position-coordinate x' and x" of a sensor. As for the image support M, the same process is repeated until only a 1 path increment advances in the direction of displacement path 1a and the progression of the location of two edges is caught covering the overall length of the image support M.
[0040] According to the option, after catching the progression of the location of only one edge R1 completely first, the path of the edge R2 of another side is caught. This approach is advantageous especially when an airline printer P is constituted as a drum recorder by the European Patent A1009158. In this case, it is arranged above one edge of image support where the sensor was first fixed to the clamp drum, and then 360 degrees of clamp drums rotate. Next, a sensor is arranged above the edge of another side and 360 degrees of tension drums rotate it again. The location of the edge of two longitudinal directions which met the fixed whole image support during each rotation of a clamp drum is determined and memorized, respectively.
[0041] Using the progression of the location of the edge of the memorized image support M, a mask is calculated in a control section C and it is arranged on the image information I which should be printed. A mask identifies all the pixels Ie of the printing image information I arranged on the outside of the edges R1 and R2 of the image support M caught beforehand. Superposition of the mask to an image information I top is performed so that the target pixel Ie may not be printed, and the value of the digital color of Pixel Ie may be set as "transparence." This mask is roughly shown in drawing 6 as a reference number 16. Drawing 7 shows roughly image information I' which remained after piling up a mask 16 on image information I and which can be printed.
[0042] By the above-mentioned approach, before printing image information I, the edge of the image support M is caught. every [a line] "under advance" although premised on the ability of the image support M to position this within an airline printer possible [reappearance in sufficient precision], this must perform marginal prehension, count of a mask, and superposition during printing processing, when [of an airline printer] constitutionally impossible. It is caught about each printing line specified by the location of the image support M in alignment with the horizontal migration of print head H and displacement path 1a in alignment with displacement path 2a, a partial mask is calculated after this, and the location of one edge of the image support M is laid on top of image information (this printing line) I.
[0043] For this reason, the pixel (this printing line) located in the outside of this edge is not printed. Print head H usually moves forward to a passage with Sensor S, and the line of image information is printed. Shortly after the edge of the opposite side of image support goes into the inspection zone of Sensor S, the location of this edge will be caught, the 2nd partial mask will be calculated after this, and it will put on image information (this printing line). For this reason, the pixel (this printing line) located in the outside of this edge is not printed, either. Then, this process is repeated like an opposite direction and the following until all image information is printed.
[0044] As already mentioned above, the edge which crosses advance direction 1a of the image support M, and extends can also be caught by Sensor S. In case the usual orientation to which advance direction 1a and Sensor S cross at right angles is performed, the signal level of all sensing elements changes all at once on the fact of Sensor S, while Sensor S passes through

said edge. The location of each edge can be determined from time or the mask (put together as the positional information of the edge of two longitudinal directions) calculated the three-dimension information and from now on of this level change.
[0045] Like prehension of the edge of two longitudinal directions, with the mechanical parameter of an airline printer etc., when the prehension before printing is impossible, prehension also of the edge of before image support or back "during advance" can be carried out. To displacement path 2a of print head H, especially 45 degrees rotate, and Sensor S can perform prehension of the edge of before or back like the format explained about drawing 5 , when being arranged, a specific include angle and.
[0046] Of course, when the edge of the caught image support has been arranged outside the preselected tolerance, it cannot make it able to start, and it not only interrupts printing processing, but it can constitute a control section C so that warning which makes and corresponds may be outputted.
[0047] According to the 2nd side face of this invention, Sensor S is used also for measurement of the test pattern sometimes printed (to coincidence). Thereby, the functional condition of print head H and relative adjustment can be inspected automatically.
[0048] Drawing 8 -11 are for explaining roughly the approach for recognizing the printing nozzle of print head H which stopped functioning by blinding. For this reason, a test pattern 10 is printed. while, as for a test pattern 10, image support moves forward -- one print head H -- about each, one or more of all the nozzles for the Isshiki are operated, and it is created. Although the nozzle which is functioning prints a short line, respectively, a line will escape from it by the nozzle which carried out blinding.
[0049] at least one of the lines of a test pattern is longer than others so that it may be unambiguous in this scan (or short) -- it is made like. Since a test pattern 10 can be made very small unlike the test pattern used for a visual inspection, it can arrange between the images and images which should be printed, and near the edge of image support.
[0050] the sensor S by which a test pattern 10 crosses the line of a test pattern -- 1 time -- or a multiple-times scan is carried out. The typical signal trace partially shown in drawing 11 is created by each sensing element (pixel coordinate p) of Sensor S during each scan. While each line of the test pattern 10 which actually exists produces a negative signal peak, when the line is missing with nozzle failure, the corresponding signal peak is also missing.
[0051] A control section C can judge [the existence of failure of the nozzle of each print head H, and] which nozzle is out of order by counting the number of peaks and distinguishing the missing peak from signal trace. Thus, when failure of one or more printing nozzles has been recognized, it is determined automatically whether printing processing is continuable with the printing nozzle of whether by preselected criteria, printing processing should be interrupted, and the maintenance control (washing, exchange) of the print head should be required or put into operation and others which are functioning.
[0052] When there are few broken printing nozzles, the activity of the nozzle which broke down between the nozzles of others which are functioning by the known approach can be shared. Generally this approach is learned as software nozzle replacement. Control of a control section C may wash print head H by using a known cleaning agent, a known approach, etc.
[0053] Drawing 9 -12 show roughly the test procedure of the relative adjustment of the print head at the time of being detected when the point printed by each printing nozzle was arranged at incorrectness. It is constituted like a test pattern 10 and the test pattern 20 which has the description of being printed by one or more print head H (it setting for the example of drawing and being H1 and H2) is printed.
[0054] In the example of drawing, it is clear that two lines' 21 and 22 of a test pattern 20 the two print heads H1 and H2 are adjusted to incorrectness in order to approach too much mutually. Furthermore, one nozzle of the print head H2 arranges to incorrectness two or more points (Rhine 23) printed by the nozzle. Typical signal trace of the pixel coordinate p acquired by the scan of a test pattern 20 is shown in drawing 12 (partially). Also in this case, a control section C analyzes these signal traces. Thereby, not only the number of the existing lines but those relative positions (pixel coordinate) are determined.

[0055] The location of each Rhine is compared with the location set up beforehand. When the gap has arisen, amendment processing is judged [whether it is the need and] automatically. On the other hand, amendment processing can consist of mechanical readjustment of print head H, or use of software amendment, and can amend the inaccurate location of inaccurate adjustment of the print head, and the printing point generated by the nozzle. A control section C can also perform mechanical readjustment of print head H automatically using an adjustment device. An adjustment device may be a motorised stop screw for adjustment of the print head, or other actuators.
[0056] According to another side face of this invention, Sensor S can be used also for measurement of a color test pattern, can investigate the color reproduction nature by the airline printer by this, and can amend it again if needed. Drawing 10 and 13 show an approach required for this roughly.
[0057] The color test pattern 30 which consists of the small color test field of plurality (the example of drawing nine pieces) where colors differ mutually is printed. Usually, the color (cyanogen, yellow, a Magenta, black) of the printing ink used, the primary color (the red, blue, green) and black which were edited, and some gray shades are used. The color measurement field of a color test pattern is scanned by Sensor S, and each color measurement field is measured by each measuring beam color.
[0058] Drawing 13 shows the typical signal trace of the pixel coordinate p to one scan path (three color measurement fields caught by one measuring beam color). The value of the concentration determined to each color measurement field about each measuring beam color is compared with the reference value beforehand memorized in the control section C, and a gap is determined. Amendment processing is started when this gap crosses the preselected tolerance.
[0059] Suitable amendment processings may be adjustment of the device profile (printer output profile) of for example, the airline printer P or new creation, all printing processings performed after that using the new profile. The approach and equipment for creating a device profile are indicated by the reference about color management, and are a well-known matter for this contractor.
[0060] The magnitude of the ink droplet generated from the nozzle of print head H may be changed by adjusting the driver electrical potential difference applied to a nozzle as automatic amendment processing replaced above. By changing the magnitude of a drop, the color reproduction property of an airline printer is also automatically controllable in a fixed limitation.
[0061] It is needed for this approach for the color test pattern 30 to have the color test field of the color of printing ink whose halftone color test field of the pure color of the color ink used, i.e., the area covered with ink, is less than 100%. These halftone color test fields are the above-mentioned approaches, and it is measured using Sensor S, those depth of shade is determined, and they are compared with a reference value.
[0062] When the depth of shade measured about a certain printing ink separates from the preselected tolerance, according to that gap, magnitude of the drop of this color ink is made greatly or small by the control section C. Thus, the color reproduction nature of an airline printer can be kept constant within limits which exist automatically.
[0063]
[Effect of the Invention] If it is in this invention as providence was carried out above, the problem at the time of producing a frameless photograph by the easy and economical approach is solvable. Thereby, especially the futility of an image support ingredient and printing ink is avoided. Moreover, it is combinable with offer of the indispensable condition for controlling other above-mentioned problems accompanying an ink jet and the same printer for the solution of the problem about production of a frameless photograph.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the principle schematic diagram showing the gestalt of desirable implementation of the airline printer by this invention.
[Drawing 2] It is drawing showing the gestalt of operation of a multifunctional mold photoelectrical sensor established in the airline printer by this invention.
[Drawing 3] It is the schematic diagram showing the inspection zone of the sensor shown in drawing 2 .
[Drawing 4] It is the expansion schematic diagram showing the train of the location of the edge of image support.
[Drawing 5] It is the functional schematic drawing explaining detection of the edge of image support.
[Drawing 6] It is the schematic diagram showing the configuration of a mask.
[Drawing 7] It is the schematic diagram showing the masked image information.
[Drawing 8] It is drawing showing the typical test pattern for controlling the functional conditions and color reproduction nature of the print head.
[Drawing 9] It is drawing showing the typical test pattern for controlling the functional conditions and color reproduction nature of the print head.
[Drawing 10] It is drawing showing the typical test pattern for controlling the functional conditions and color reproduction nature of the print head.
[Drawing 11] It is drawing showing typical measurement data.
[Drawing 12] It is drawing showing typical measurement data.
[Drawing 13] It is drawing showing typical measurement data.
[Description of Notations]
1 Positioning Means
1a Displacement path
2 Advance Means
2a Displacement path
3 Driving Means
10 Test Pattern
11 Light Emitting Diode
12 Prehension Lens
13 Optical/electrical Converter
13a Drive electronic instrument
15 Inspection Zone
16 Mask
20 Test Pattern
21, 22, 23 Line of a test pattern
30 Color Test Pattern

[Translation done.]